

COMMANDMENTS FOR COMMUNICATION

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Most scientific papers are monotonously unexciting. Their authors conduct carefully planned experiments. The conclusions and hypotheses are supported by data. The written reports are concise, lucid and desiccated. All scientific journals contain numerous examples of such middle class mediocrity.

It is possible to break the strait-jackets of conventionality and provide tingles of expectation and excitement for journal editors and readers. Through development of appropriate skills, the writer may be able to vastly enhance his reputation. Granted the novice is often inept. But with practice and devotion to duty he may succeed in engendering the necessary perception and technical virtuosity.

The procedures are relatively simple. An annotated enumeration follows.

1. *Publish quickly.* Preliminary experiments have provided some ideas. Get them in print. If follow-up work needs to be done to complete the experiment, or to satisfy the skeptics, this can be conducted later. It will yield additional titles for your publication list.

2. *Recognize that writing is unimportant* to a scientist. Writing is the sphere of Professors of English, and those who prepare advertising copy. The primary responsibilities of a scientist end when he comes out of the laboratory.

3. *Go easy on literature.* Do not read publications relating to your undertaking. This requires time that could better be used otherwise. In any event, most investigations completed more than five years in the past are valueless (unless, of course, they were done in your laboratory).

4. *Ignore journal format.* Most journals publish in each issue a set of recommendations for prospective authors. These usually represent an expression of the eccentricities of the editor and improperly inhibit freedom of expression of authors.

5. *Master the mechanics of paper preparation.* It is conventional to have a manuscript typed. If it is single-spaced it will save paper. If changes need to be made, write them in the margins. Inconsistencies in headings, figure and table format, and in citations add variety and spice. Use abbreviations of your own invention; these help in providing a personal touch. Above all don't verify literature citations. It is best to leave some of them incomplete. Most readers of scientific papers are graduate students who need experience in library searching.

6. *Consider means of effective writing.* (If this isn't your meat, place emphasis instead on tables and figures—commandment no. 7).

There are scientists who actually like to write and whose exceptional qualities are best revealed in the written word. The basic objective is to keep the reader fooled as long as possible.

If possible dispense with organization as formulized by headings such as "materials and methods," "observations," etc. However, a skillful writer can prepare a paper which complies with organizational etiquette and yet has no point whatsoever. Perhaps this is beyond most of us. But some helpful hints:

Use similar headings for various levels of content categories. Present some of the "observations" under "materials and methods" and again in the "discussion." Repeat in the summary exactly what was said in the "observations" so as to provide proper emphasis.

Avoid limiting a paragraph to a single idea or sequence of ideas, but change subject two or three times in the same paragraph. Then, three paragraphs down, go back to one of the first topics again.

The use of definitive grammar and spelling is not improper. However, it is more important that you be yourself. Do not be inhibited by restrictive regulations. Write as you would speak.

Much has been said about brevity or the lack of it. Turn to page 3 of the Style Manual for Biological Journals (1) where a throbbing paragraph has been editorially burned to a shriveled cinder. The soul of the author is gone!

7. *Don't neglect tables and figures.* One of the frequent byproducts of research is the accumulation of a lot of numbers which represent the results of counting or measuring. We call these numbers data. Something has to be done with them. The usual procedure is to stack them into piles and stuff them into tables.

If you are a hungry data hunter, tables are really for you. The best are many-columned, each with its neat rows of little figures; they have a pleasantly hypnotic effect. Be sure to present the original data, not summaries. However, statistical or mathematical embroidery following pages of numbers adds sophistication and ultimate finality to one's endeavors.

The artistic possibilities of figures possessing numerous wavy lines, intersecting bars, and amorphous spots are limitless. Some authors like the homey feeling of figures prepared on second hand graph paper and lettered by hand.

8. *Consider alternatives in data interpretation.* Commandment no. 7 dealt with the disposal of data in conveniently accessible tables. This should constitute a reasonable end to the matter. However, many workers insist that verbal mauling of the bulging tables is essential. There are several attractive procedures available to the disciplined scientist.

(a) The simplest gambit is to ignore the tables. Proceed with a learned and philosophical consideration of your conclusions but don't refer to the data. This might confuse the reader. Indeed, possibly it might confuse you and this should be avoided.

(b) Or, meet the data head on. This is the best alternative for no-

nonsense, pragmatic individuals. For example: Table 11 indicates a germination of 87% of dodder seed at an alternating 20-30°C. with light. One can call attention to this fact in the observations, and repeat the statement in the discussion and conclusions. In this manner, the point is driven home. Likewise for the other seed kinds in Table 11, and likewise for Table 12, etc. It is unwise, however to consider Tables 11 and 12 in relationship to one another, or with respect to broader problems.

(c) In any event, draw definite conclusions. A conclusion is only as good as the vigor of its enunciation. Do not consider the possibility that more than one hypothesis may have validity for the information available (or, Heaven forbid, an insufficiency in experimental design nullifying the possibility of a clear conclusion). An illustration of the relationship between observations and conclusions follows:

My neighbor used to own a small dog that loved to chase butterflies. One day, a butterfly flew across the street and the dog went after it. He was hit by a car. He was laid up but recovered. Thereafter, he was deathly frightened of butterflies and would flee screaming whenever he saw one.

(d) The most courageous way of dealing with data is simply to do without it. Data often unduly prejudice readers and hinder a clear exposition. Again an example: I have recently read an excellent book on evolution by one of our most distinguished geneticists (2). Throughout the book, he develops a meticulous pattern of argumentation based upon accumulated data of genetics, taxonomy, evolutionary theory, etc. His imaginative speculation is carefully related to such data. However, in the last chapter dealing with human evolution, he lets himself go. He discusses the relative evolutionary potentialities of various attributes of human beings. For example he considers the reproductive rates of beautiful and less beautiful women. He states, "Beautiful women do not on the average have the most children, largely because of competing interests of stage, screen and promiscuous manhunting." The elegance of this thought-provoking statement is its apparent freedom from any kind of organized data. Scientific literature is replete with such assertions, albeit most of them on less interesting topics.

9. *Avoid manuscript reviews.* Some authors are worry-warts. They scan their completed manuscript again and again, and annoy their colleagues with requests for suggestions. This is a wasteful procedure that betrays lack of self-confidence. Besides alienating your friends, it delays publication. When the thing is done, it's done. Move on!

Unfortunately many institutions require examination of manuscripts by a review committee before they are submitted for publication. Most journals have review panels. There is nothing an author can do about this; he can only endure patiently. Some reviewers take the time to make numerous suggestions. These can quietly be placed in the circular file.

10. *Publish.* We have gone full circle. Our first commandment was to publish. So is the last. Publication is the mark of achievement in the scientific world. Another citation for the list and another reprint for distribution. Rapid and continuous publication is essential for professional

growth, status with grant foundations, and standing in the community. And it is alleged that St. Peter examines the publication list of all defunct scientists.

LITERATURE CITED

1. CONFERENCE OF BIOLOGICAL EDITORS, COMMITTEE ON FORM AND STYLE. 1964. Style manual for biological journals. Second edition. American Institute of Biological Sciences, Washington, D.C.
2. Citation furnished on request.